CLAIMS

What is claimed is:

1. A method of producing hydrogen comprising: reacting water and a water-soluble oxygenated hydrocarbon having at least two carbon atoms, in the presence of a metal-containing catalyst, wherein the catalyst comprises a metal selected from the group consisting of Group VIII transitional metals, alloys thereof, and mixtures thereof.

2. The method of Claim 1, wherein the water and the oxygenated hydrocarbon are reacted at a temperature of from about 100°C to about 450°C, and at a pressure where the water and the oxygenated hydrocarbon are gaseous.

3. The method of Claim 1, wherein the water and the oxygenated hydrocarbon are reacted at a temperature of from about 100°C to about 300°C, and at a pressure where the water and the oxygenated hydrocarbon are gaseous.

4. The method of Claim 1, wherein the water and the oxygenated hydrocarbon are reacted at a temperature not greater than about 400°C, at a pressure where the water and the oxygenated hydrocarbon remain condensed liquids.

5. The method of Claim 1, wherein the water and the oxygenated hydrocarbon are reacted at a pH of from about 4.0 to about 10.0.

6. The method of Claim 1, wherein the catalyst comprises a metal selected from the group consisting of nickel, palladium, platinum, ruthenium, rhodium, iridium, alloys thereof, and mixtures thereof.

7. The method of Claim 1, wherein the catalyst is further alloyed or mixed with a metal selected from the group consisting of Group IB metals, Group IIB metals, and Group VIIb metals.

8. The method of Claim 1, wherein the catalyst is further alloyed or mixed with a metal selected from the group consisting of copper, zinc, and rhenium.

9. The method of Claim 1, wherein the catalyst is adhered to a support.

10. The method of Claim 9, wherein the support is selected from the group consisting of silica, alumina, zirconia, titania, ceria, carbon, silica-alumina, silica nitride, and boron nitride.

11. The method of Claim 9, wherein the support is surface-modified to remove surface moieties selected from the group consisting of hydrogen and hydroxyl.

12. The method of Claim 9, wherein the support is modified by treating it with a modifier selected from the group consisting of silanes, alkali compounds, and alkali earth compounds.

13. The method of Claim 9, wherein the support is silica modified with trimethylethoxysilane.

14. The method of Claim 9, wherein the support is a zeolite.

15. The method of Claim 9, wherein the support is a carbon nanotube or a carbon fullerene.

16. The method of Claim 9, wherein the support is a nanoporous support.

17. The method of Claim 1, wherein the water and the oxygenated hydrocarbon are reacted at a temperature not greater than about 400°C, at a pressure where the water and the oxygenated hydrocarbon remain condensed liquids, and further comprising reacting the water and the water-soluble oxygenated hydrocarbon in the presence of a water-soluble salt of an alkali or alkali earth metal.

18. The method of Claim 17, wherein the water-soluble salt is selected from the group consisting of an alkali or an alkali earth metal hydroxide, carbonate, nitrate, or chloride salt.

19. The method of Claim 1, wherein the water-soluble oxygenated hydrocarbon has a carbon-to-oxygen ratio of 1:1.

20. The method of Claim 1, wherein the water-soluble oxygenated hydrocarbon has from 2 to 12 carbon atoms.

21. The method of Claim 1, wherein the water-soluble oxygenated hydrocarbon is selected from the group consisting of ethanediol, ethanedione, glycerol, glyceraldehyde, aldotetroses, aldopentoses, aldohexoses, ketotetroses, ketopentoses, ketohexoses, and alditols.

22. The method of Claim 1, wherein the water-soluble oxygenated hydrocarbon is selected from the group consisting of aldohexoses and corresponding alditols.

23. The method of Claim 1, wherein the water-soluble oxygenated hydrocarbon is selected from the group consisting of glucose and sorbitol.

24. The method of Claim 1, wherein the water-soluble oxygenated hydrocarbon is sucrose.

25. A method of producing hydrogen comprising: reacting water and a water-soluble oxygenated hydrocarbon having at least two carbon atoms, at a temperature not greater than about 400°C, at a pressure where the water and the oxygenated hydrocarbon remain condensed liquids, and in the presence of a metal-containing catalyst, wherein the

catalyst comprises a metal selected from the group consisting of Group VIII transitional metals, alloys thereof, and mixtures thereof.

26. The method of Claim 25, wherein the catalyst comprises a metal selected from the group consisting of nickel, palladium, platinum, ruthenium, rhodium, iridium, alloys thereof, and mixtures thereof.

27. The method of Claim 25, wherein the catalyst is further alloyed or mixed with a metal selected from the group consisting of Group IB metals, Group IIB metals, and Group VIIb metals.

28. The method of Claim 25, wherein the catalyst is further alloyed or mixed with a metal selected from the group consisting of copper, zinc, and rhenium.

29. The method of Claim 25, wherein the catalyst is adhered to a support.

30. The method of Claim 29, wherein the support is selected from the group consisting of silica, alumina, zirconia, titania, ceria, carbon, silica-alumina, silica nitride, and boron nitride.

31. The method of Claim 29, wherein the support is surface-modified to remove surface moieties selected from the group consisting of hydrogen and hydroxyl.

32. The method of Claim 31, wherein the support is modified by treating it with a modifier selected from the group consisting of silanes, alkali compounds, and alkali earth compounds.

33. The method of Claim 29, wherein the support is silica modified with trimethylethoxysilane.

34. The method of Claim 29, wherein the support is a zeolite.

35. The method of Claim 29, wherein the support is a carbon nanotube or a carbon fullerene.

36. The method of Claim 29, wherein the support is a nanoporous support.

37. The method of Claim 25, further comprising reacting the water and the water-soluble oxygenated hydrocarbon in the presence of a water-soluble salt of an alkali or alkali earth metal.

38. The method of Claim 37, wherein the water-soluble salt is selected from the group consisting of an alkali or an alkali earth metal hydroxide, carbonate, nitrate, or chloride salt.

39. The method of Claim 25, wherein the water-soluble oxygenated hydrocarbon has a carbon-to-oxygen ratio of 1:1.

40. The method of Claim 25, wherein the water-soluble oxygenated hydrocarbon has from 2 to 12 carbon atoms.

41. The method of Claim 25, wherein the water-soluble oxygenated hydrocarbon is selected from the group consisting of ethanediol, ethanedione, glycerol, glyceraldehyde, aldotetroses, aldopentoses, aldohexoses, ketotetroses, ketopentoses, ketohexoses, and alditols.

42. The method of Claim 25, wherein the water-soluble oxygenated hydrocarbon is selected from the group consisting of aldohexoses and corresponding alditols.

43. The method of Claim 25, wherein the water-soluble oxygenated hydrocarbon is selected from the group consisting of glucose and sorbitol.

44. The method of Claim 25, wherein the water-soluble oxygenated hydrocarbon is sucrose.

45. A method of producing hydrogen comprising: reacting water and a water-soluble oxygenated hydrocarbon having at least two carbon atoms, at a temperature of from about 100°C to about 450°C, and at a pressure where the water and the oxygenated hydrocarbon are gaseous, in the presence of a metal-containing catalyst, wherein the catalyst comprises a metal selected from the group consisting of Group VIII transitional metals, alloys thereof, and mixtures thereof, the catalyst being adhered to a support.

46. The method of Claim 45, wherein the support is selected from the group consisting of silica, alumina, zirconia, titania, ceria, carbon, silica-alumina, silica nitride, and boron nitride, modified to remove surface moieties selected from the group consisting of hydrogen and hydroxyl.

47. The method of Claim 46, wherein the support is modified by treating it with a modifier selected from the group consisting of silanes, alkali compounds, and alkali earth compounds.

48. The method of Claim 45, wherein the support is silica modified with trimethylethoxysilane.

49. The method of Claim 45, wherein the water-soluble oxygenated hydrocarbon has a carbon-to-oxygen ratio of 1:1.

50. The method of Claim 45, wherein the water-soluble oxygenated hydrocarbon is selected from the group consisting of ethanediol, ethanedione, glycerol, glyceraldehyde, aldotetroses, aldopentoses, aldohexoses, ketotetroses, ketopentoses, ketohexoses, and alditols.

51. A method of producing hydrogen comprising: reacting water and a water-soluble oxygenated hydrocarbon having at least two carbon atoms, at a temperature of not greater than about 400°C, and at a pressure where the water and the oxygenated hydrocarbon remain condensed liquids, in the presence of a metal-containing catalyst, wherein the catalyst comprises a metal selected from the group consisting of Group VIII transitional metals, alloys thereof, and mixtures thereof, the catalyst being adhered to a support.

52. The method of Claim 51, wherein the support is selected from the group consisting of silica, alumina, zirconia, titania, ceria, carbon, silica-alumina, silica nitride, and boron nitride, modified to render to remove surface moieties selected from the group consisting of hydrogen and hydroxyl.

53. The method of Claim 52, wherein the support is modified by treating it with a modifier selected from the group consisting of silanes, alkali compounds, and alkali earth compounds.

54. The method of Claim 51, wherein the support is silica modified with trimethylethoxysilane.

55. The method of Claim 51, wherein the water-soluble oxygenated hydrocarbon has a carbon-to-oxygen ratio of 1:1.

56. The method of Claim 51, wherein the water-soluble oxygenated hydrocarbon is selected from the group consisting of ethanediol, ethanedione, glycerol, glyceraldehyde, aldotetroses, aldopentoses, aldohexoses, ketotetroses, ketopentoses, ketohexoses, and alditols.